Supervised Autonomous Fires Technology (SAF-T)

AT A GLANCE

WHAT IS IT?

Supervised autonomy will enable the next generation of remote weapon stations (RWS), allowing safe and operationally effective weaponization of unmanned ground and sea systems. It will overcome current limitations of RWS such as limited situational awareness and command latency by allocating operator tasks—targeting, tracking and fire control—to the software systems on the platform using automated target detection, decision and engagement systems.

HOW DOES IT WORK?

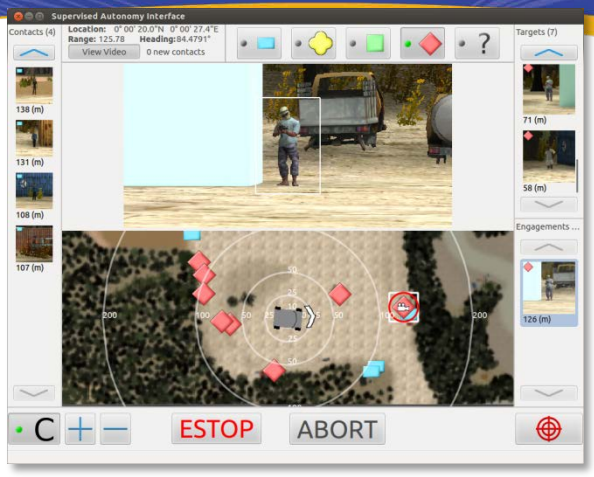
- Autonomous target detection and tracking algorithms combine optical saliency with more basic motion, thermal and shape detectors for a hybrid, compound, cascade classifier to detect and track targets of interest using fused visible and infrared video from high-resolution RWS optics
- Automated decision system helps operators make informed engagement decisions using target discriminators auto-generated by the weapon system
- Once operators authorize engagement, autonomous fire control algorithms enable dynamic target engagement with fire control cognition, pattern logic and corrective fires systems

WHAT WILL IT ACCOMPLISH?

- Faster, more accurate, more capable RWS
- Reduced manpower requirements for RWS operation on manned vehicles
- Wireless remote operation of RWS from moving unmanned platforms
- Detection and tracking of potential and confirmed threats
- Less ammunition required to engage targets
- Reduced time to engage targets

POINT OF CONTACT:

Dan Simons
Fires Thrust Manager
dan.simons@navy.mil



Unmanned systems are a focus of future combat development, but effective weaponization of unmanned ground systems (UGS) and improved use of remote weapons stations (RWS) requires a paradigm shift in weapon command and control to overcome the problems of limited situational awareness and command latency inherent in current teleoperated (TO) control schema. The SAF-T project seeks to address these limitations through development of a supervised autonomous (SA) fire control system that autonomously identifies, tracks and computes firing solutions for targets within the effective range of the weapon system but communicates with the operator for engagement decisions.

To aid in creating and validating the SAF-T concept, quantifying system performance and human system interaction requirements, and enabling concept trade studies to inform technical development, a simulation was developed leveraging the Unity3D game engine and the Robotic Operating System.

The fiscal year 2013 SAF-T project developed a virtual prototype and environment to test the system's usability with both civilian and Marine operators. Measures of performance were collected on the performance of users engaging targets in a simulated series of engagements using the SAF-T versus a teleoperated RWS. The differences in performance were measured, and data from this test series informed system developers on changes to the graphical user interface and experimental design for the system's maturation.

The fiscal year 2014 SAF-T project is continuing the virtual prototyping, simulation and experiment work to further define system requirements. Work also has begun on initial implementation of detection and tracking algorithms for targets of interest. Fiscal year 2015 will extend the detection and tracking algorithms and develop weapon and fire-control algorithms. Integration will commence on an RWS as a test bed for testing the SAF-T system's performance.

Research Challenges and Opportunities:

- Develop detection and tracking algorithms that can reliably detect and track targets with low false positive and low false negative rates
- Develop compute solutions for algorithms that will provide real-time performance to enable weapon engagement of targets
- Develop a decision system that reduces user workload, increases user trust of the autonomous system and operates over wireless data link
- Develop fire-control algorithms with corrective fire that can autonomously aim and fire a weapon